Statistical hadronization model predictions for charmed hadrons at LHC

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Abstract. We present predictions of the statistical hadronization model for charmed hadrons production in Pb+Pb collisions at LHC.

The results presented below are discussed in detail in our recent publication [1]. We summarize here the values of the model parameters: i) characteristics at chemical freeze-out: temperature, T=161±4 MeV; baryochemical potential, μ_b=$0.8^{+1.2}_{-0.6}$ MeV; volume corresponding to one unit of rapidity V=6200 fm^3; ii) charm production cross section: $\mathrm{d}\sigma^{pp}_{c\bar{c}}/\mathrm{d}y = 0.64^{+0.64}_{-0.32}$ mb.

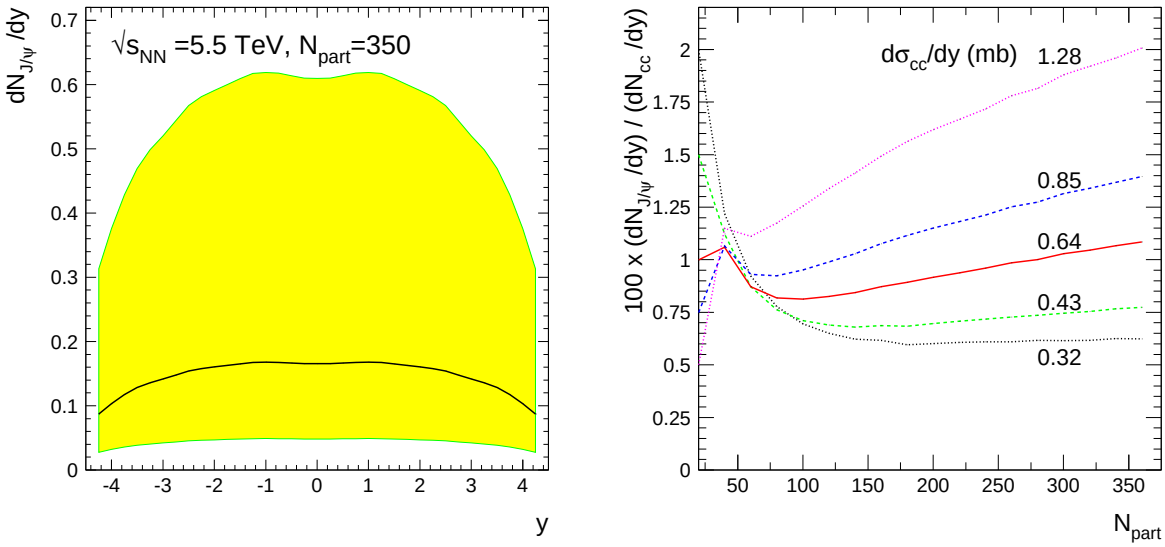

Figure 1. Predictions for J/ψ yield: rapidity distribution for central collisions (left panel) and centrality dependence of the yield relative to the charm production yield for different values of the charm cross section indicated on the curves (right panel).

In Fig. 1 we present predictions for the yield of J/ψ. The left panel shows the rapidity distribution with the band reflecting the uncertainty in the charm production cross section. The right panel shows the centrality dependence of the yield relative to the charm production yield for five values of the input charm cross section.

The statistical hadronization model predictions for charmed hadron yield ratios in central Pb+Pb collisions at LHC are shown in Table 1. We expect that these ratios are independent of centrality down to values of $N_{part} \simeq 100$.

Table 1. Predictions of the statistical hadronization model for charmed hadron ratios for Pb+Pb collisions at LHC. The numbers in parantheses represent the error in the last digit(s) due to the uncertainty of T.

D^-/D^+	$\bar{D}_0/D_0$	D^{*-}/D^{*+}	D_s^-/D_s^+	$\bar{\Lambda}_c/\Lambda_c$	D^+/D_0	D^{*+}/D_0
1.00(0)	1.01(0)	1.01(0)	1.00(1)	1.00(1)	0.425(18)	0.387(15)

D_s^+/D_0	Λ_c/D_0	ψ'/ψ	η_c/ψ	χ_{c1}/ψ	χ_{c2}/ψ
0.349(14)	0.163(16)	0.031(3)	0.617(14)	0.086(5)	0.110(8)

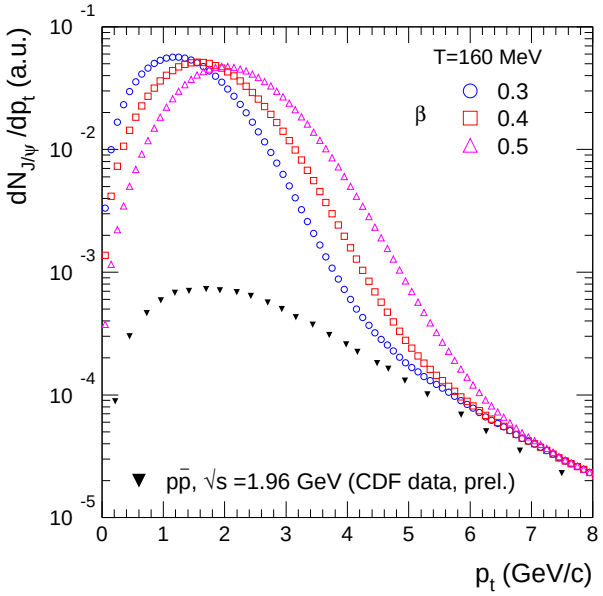

Figure 2. Predictions for momentum spectrum of J/ψ meson for different values of the average expansion velocity, β, for central Pb+Pb collisions (N_{part}=350). Also included is the measured spectrum in $p\bar{p}$ collisions at Tevatron [2], which is used to calculate the contribution from the corona (see ref. [1]).

Following from our model assumption of charm quark thermalization and assuming decoupling of charm at hadronization, the transverse momentum spectra of charmed hadrons can be calculated [1]. As seen in Fig. 2, a precision measurement of the spectrum of J/ψ meson will allow the determination of the expansion velocity in QGP.

References

[1] A. Andronic, P. Braun-Munzinger, K. Redlich, and J. Stachel. Statistical hadronization of heavy quarks in ultra- relativistic nucleus nucleus collisions. *Nucl. Phys.*, A789:334–356, 2007.

[2] G. Pauletta. Heavy flavour production at the tevatron. *J. Phys.*, G31:S817–S824, 2005.